GPS based Toll Collection System

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Abstract— Toll collection system used in our country presently is time consuming. Each and every vehicle has to wait in a queue. The person who collects toll has to work fast. Due to these many errors occur, such as toll calculation, fuel loss, etc. In this paper we have analyzed the system which meet the requirements of toll collection system. The system developed in this study is an automatic multitasking system.

Key words: GPS, Toll Collection System

I. INTRODUCTION

Road transportation is a leading part for development of the country. In India day-by-day number of vehicles on roads are increasing which results in traffic jam. While travelling we often visit toll booths where we see a long queue of vehicles. The Toll is the system of fee collection from vehicle owners who used roadway facilities. The toll fee collection is done manually via cash or cards at toll booths. Toll booth system in late 90s requires two persons for opening and closing of the gate. Two more persons are required for the collection of the money. Later on, the development of Express Highway Systems introduced semiautomatic toll plazas in the year of 1995. In this system data is stored in computers and operation of gate is automatic.

The paper based ticketing system is used at many toll booths presently. In this system manual toll collection system is used. Each vehicle has to stop on arrival at the toll booth. Then the toll collector determines the amount to be paid by each vehicle based upon its classification. Then the vehicle owner pays the fare and was then allowed to pass the toll booth. The above system is time consuming, creating long queues at toll booth. It also results in wastage of fuel and air pollution. Human errors may also lead to the incorrect toll collection. Some people may run away without paying the toll also. This can be overcome by automating the manual toll booths into GPS or Global Positioning System based toll collection system. The Global Positioning System is a satellite navigation system that furnishes location and time information in all climate conditions to the user. We have designed a useful and convenient application which spares people the trouble of stopping their vehicle and waiting in queues for hours at toll locations.

II. EXISTING SYSTEM

Revenue generated from toll is used for road construction, extension and maintenance. The most common methods used for collecting the toll from the road user are manual method. In India three toll systems exist via Open system contains mainline barrier toll plazas; closed system which has entry/exit and Electronic toll collection system which has no toll booths having only electronic toll collection gantries at entrances and exits on the road.

In an Open toll collection system, all vehicles stop on roads for paying toll. This causes traffic jams. Drivers may be able to avoid tolls by exiting and reentering the highway.

In a closed system, vehicles collect a ticket when entering the highway. In some cases, the ticket displays the toll to be paid on exit. Upon exit, the driver may lose the ticket.

In an electronic toll collection system tolls are usually collected with the use of a transponder placed before the Gate. As soon as the vehicle reaches near the transponder the amount is deducted and gate will be opened. But many vehicle owners may not have a debit card which does not allow them to pass the toll. Hence, all above methods of toll collection have a disadvantage. Toll fee is collected manually via cash or card transaction which consumes time. The stopping of vehicles results in traffic jam at the toll booths during peak hours. This results in fuel inefficiency and wastage of time. An Electronic system is not usable for vehicle owners who are not having debit cards.

III. PROPOSED SYSTEM

The purpose of this paper is to provide a fast and safe system for toll collection. Proposed system controls all vehicles automatically at toll booths by using GPS technology.

A GPS-based highway toll collection system was developed by equipping a micro-controller with third-generation (3G) and GPS connectivity. The constant acquisition of GPS coordinates acts as the basis to trace travelling vehicle and to perform all necessary toll collections. With additional works to improve the overall system accuracy and reliability, the proposed system can easily be commercialized as a future toll collection technology.

The proposed system of GPS based toll collection system is having three modules:

A. Vehicles

This module comprises of GPS receiver, GSM modem and IR receiver. In this module GPS modem receives latitude and longitude of earth from satellite and fed to ARM processor, which checks the status of the IR receiver.
B. Toll
This module consists of IR receiver, controller and GSM modem. When a vehicle enters toll unit the IR receiver receives the signal from IR transmitter. Then the ARM processor sends message about the vehicle and current location to controlling center.

C. Controlling Centre
This module contains GSM modem interfaced with the computer. This computer receives the message via GSM modem and process it based on GPS value and vehicle ID, then charges will be applied for that vehicle and toll amount will be cut from the vehicle owner’s account. If the vehicle owner is not having sufficient money in his account, then he has to pay money in toll unit. The paid information system passes to controlling center, which allows the vehicle to go. Android application has been developed. All users and toll booth will have this application. The user will decide source and destination. Geo fencing is used to identify areas of user within the area of Geo fencing, toll will be deducted from the user’s valet. User will verify paid tolls on toll booth.

IV. SYSTEM DESIGN
The process of defining the architecture, components, modules, interfaces, and data for a system to fulfil specified requirements is system design. Systems design could be seen as the application of systems theory to product development. The design must be set by the project management to coordinate the collective efforts of the team. System design includes system architecture. The system architecture is the conceptual model that defines the structure, behavior, and more views of a system.

V. ADVANTAGES
1) Avoid the fuel loss
2) Saving of time in toll collection
3) To monitor the traffic flow smoothly
4) Minimizes the operating cost
5) Minimizes human resources
6) No Waiting time of the vehicles
7) No traffic congestion
8) An assured and accurate collection of toll amount.
9) Free from cash.
10) Minimum emission which is harmful for living beings

VI. CONCLUSION
This paper tells us about the application of the automatic toll collection system on toll gates. This paper investigates how to use GUI for collection of tolls, the real time management and monitoring is done. It has expanded capacity for vehicle without building the big infrastructures. It has improved efficiency and reliability of toll plazas and traffic abilities of highways.

This paper has proposed to collect toll fees from the owners of the vehicle. It helps to avoid wastage of time and fuel because of the large traffic jams has been solved by implementing toll collection using GPS. All vehicles are identified uniquely by the GPS, and the amount is debited from the respective account of the vehicle’s owner, which is
acknowledged by the SMS to owner of the vehicle. Since everything is computerized, the undercharge or over charge collection of toll by private agencies is solved.

The proposed system is based on a combination of mobile communication technology (GSM) and a satellite based global positioning system (GPS). An innovative log on unit OBU, which automatically calculate the amount of charge due and take into account, depends on the type of the vehicle. It will also act like a platform for vehicle identification and prove effective in tracking stolen vehicles. With regard to future expansion and development, the satellite-based toll collection system will be a better solution, especially with regard to flexibility when it comes to extending toll collection to every road category.

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